



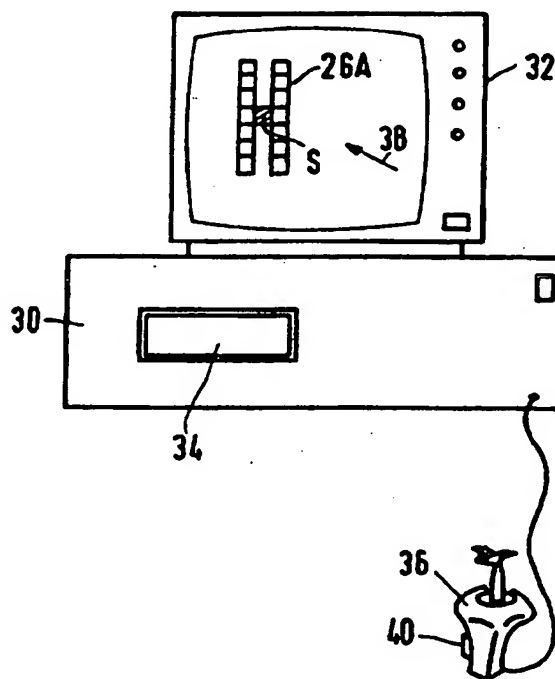
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: SECURITY CODE INPUT

## (57) Abstract

A security code entry method is provided for restricting access to a computer-based system having a processor (30), a display (32), and user input means (34, 36) arranged to move an indicator (38) about the display under user control. When access is required the user is presented, via the display, with a display pattern (26A) comprising a start point (S) and a number of target points, with the security code comprising a predetermined sequence of the target points. To enter the code, the user is required to move the apparent position of the indicator (display of which is inhibited) through the predetermined sequence of target points. The layout of the target points (26A) may be changed after each attempt to enter the code, and the code itself may be carried in a sequence of arrangements of target points.



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## DESCRIPTION

## SECURITY CODE INPUT

5           The present invention relates to methods for security coding and in particular to a method for restricting access to a computer-based system having a processor, a display, and user input means arranged to move an indicator about the display under user control, the method requiring correct entry by the user of a predetermined security code as  
10           a prerequisite to access. The invention also relates to an apparatus having such restricted access.

          As networked computer services of various kinds become increasingly common, there will be many more situations where a user is required to provide some form of security identification to the service  
15           in use. Examples include a personal identification number (PIN) for a banking transaction, an account code or a credit card number for a home shopping service, and a password or other conditional access code for on-line information. At present, the most commonly-met user identifications are PINs keyed into cash machines via keypads, and user  
20           passwords typed into computer systems via keyboards. These methods require a set of physical numeric or alphanumeric keys which can be operated in a secure manner, without revealing the PIN or password to other people in the vicinity.

          A similar level of security needs to be provided for services where  
25           all user interaction takes place by moving a cursor or other indicator around a menu screen and selecting menu entries as indicated. At the simplest level, the user input may comprise a simple XY pointing device with a small number of buttons (maybe only two). An example of this would be a CD-i (Compact Disc - Interactive) player connected to a

public data network with a remote control being used to purchase films offered by a Video on Demand service through the network.

It is an object of the present invention to provide the user with a convenient yet secure way of communicating a secret access code to a computer system just using a pointing device and a visual display.

In accordance with the present invention, there is provided a method for restricting access as set forth in the opening paragraph, characterised in that;

- the user is presented, via the display, with a first pattern comprising a start point and a plurality of target points arranged related thereto, and the security code comprises a predetermined sequence of the target points;

- the user is required to move the indicator through the predetermined sequence of target points whilst display of the indicator is inhibited; and

- on determining that the indicator has been moved through a sequence of target points, an indication is provided to the user if that sequence does not correspond to the predetermined sequence.

Preferably, the first pattern (which may simply comprise a grid arrangement of alphanumeric and/or graphical symbols arranged around the start point) further comprises an end point, with the determination that the indicator has been moved through a sequence of target points occurring when the indicator is moved by the user to the end point. Where the user input means is operable to select items on the display when indicated by the indicator, correct entry of the security code may further require selection of a predetermined one or ones of the target points in the predetermined sequence.

To increase security, for one or more target points of the first

pattern, selection of (or placing the indicator on) that target point may be specified to cause the first pattern to be changed to a second pattern of target points: this may be extended to bring a change to a third pattern from the second, a fourth from the third and so on with, in the extreme, the pattern being changed for each indicated or selected target point of the sequence, and with only one correct target point in each pattern. The changed pattern may comprise the respective target points of the preceding pattern rearranged on the display, or it may include one or more target points not included in the preceding pattern. With such a system of changing patterns, each pattern preferably includes a start point and, on changing from the preceding pattern, the indicator is preferably positioned at the start point of the new pattern. As a further security precaution, the target points of the first pattern may be repositioned for each successive attempt to enter the correct sequence.

In order to enable a user to cancel an attempt (for example if the user becomes aware that he/she has made a mistake in following the sequence) an escape point is preferably provided, the selection (or indication) of which restarts the users sequence input. Where only a single pattern of target points is provided, such escape may be provided by returning the indicator to the start point after commencing the sequence.

Also in accordance with the present invention there is provided a computer-based apparatus having access restricted by the method of the present invention, the apparatus including a target point store holding data specifying the respective locations of the target points on the display; a security code store holding at least one security code; first comparator means arranged to receive an identification of current indicator position, compare this with the target point location data from

the target store, and output an identification of a currently indicated target point; and second comparator means arranged to receive a sequence of the identifications from the first comparator means, compare that sequence with the code in the security code store, and output one or more signals indicating whether or not there is a match. Suitably, the target point store holds a plurality of target point arrangements and the apparatus may further include a pseudo-random selector arranged to select which target point arrangement is displayed.

Further features and advantages of the present invention will become apparent from reading of the following description of preferred embodiments of the present invention, given by way of example only, and with reference to the accompanying drawings in which:

Figure 1 is a block schematic diagram of a networked CD-i system embodying the invention;

Figure 2 is a block schematic diagram of a games system console embodying the invention;

Figure 3 schematically represents a code storage and comparison stage embodying the invention;

Figure 4 shows a first arrangement of screen targets;

Figure 5 shows a modified version of the arrangement of Figure 4; and

Figure 6 shows a sequence of target arrangements according to an alternative embodiment of the present invention.

A first arrangement of apparatus in which the security scheme of the invention may be employed is shown in Figure 1. A CD-i player 10, connected to display on a television screen 12, is coupled (via link 14) to a consumer data network under control of network server 16. The

network server 16 is configured to provide services to users such as Video on Demand, in which the user may select from a menu of available feature films which are then downloaded to the CD-i 10 over the data link 14.

5           Selection from an on-screen menu of available films is made using a remote controller 18 of the CD-i which enables the user to control the movement (by up/down/left/right controls 20) of a cursor or select bar 22. A select button 24 is used to indicate that the choice currently marked by the cursor is the desired option. On receiving the selection,  
10           the network server 16 then requests the user to enter a security code via a displayed grid of targets 26 to confirm that the user is a registered subscriber to the service.

          An alternative system employing the target-based security code scheme is shown in Figure 2 comprising a computer games console 30  
15           with a display screen 32. The games console may suitably be of the type which accepts different games loaded as cartridges 34. Movement of a cursor 38 may be achieved by use of a joystick 36 or trackerball (not shown) and selection of a target from the displayed grid 26A is achieved by pressing the joystick "fire" button 40. In a 'stand-alone'  
20           application as shown, the coding scheme may be used to restrict access by minors to certain games, such as games having a highly violent content.

          The general form of interaction to enter security codes is as follows:

25           1.     At the moment the service or device requires the user to input a code, a display will appear containing a pattern of visible targets and a start point.

          2.     The XY pointing device will be used to move around a sequence of these targets already known to the user and corresponding

to the access code. While this is happening, there is no visible counterpart (such as the cursor) on the display - the display is simply an aide-mémoire for the user. The cursor may remain visible until such time as the user has moved it from outside the pattern of targets to the start point but preferably the cursor would be automatically relocated to the start point and blanked simultaneously with the appearance of the target pattern.

3. During movement of the "invisible" cursor, the user may need to press a button on the controller (for example the "fire" button 40, Fig.2), or the display may change spontaneously as the XY control is moved, as will be described below.

4. Once the code has been communicated, an accept or reject response will be generated by the service. This may comprise a visual or audio indication or (for successful entry) this may simply be indicated by the granting of access.

A storage and comparison stage for the code input technique is shown in Figure 3. This may comprise a dedicated hardware arrangement or the respective functions may be assigned to existing storage and processor devices of, for example, the CD-i player 10 or games console 30 of Figures 1 and 2 respectively.

A target point store 42 holds display data and screen positions for a number of target point arrangements, with the particular arrangement displayed being selected by a pseudo-random selector 44. A first comparator 46 receives the x,y screen position of the cursor and compares this with the target point positioning data for the selected arrangement from the store 42 to determine which target point is current being indicated (which target the non-displayed cursor currently lies on). Where the operation requires selection (as in 3. above) the comparator may only carry out the current target point determination on



receiving a "select" command from the user input device.

5 The sequence of target points identified by the first comparator 46 is passed to a second comparator 48 which compares the sequence with a security code or one of a number of security codes in the form of target point sequences and held in a further store 50. When compared, the comparator outputs a match/no-match signal to indicate whether the user-entered code is accepted or rejected.

10 The targets themselves can contain any sort of graphic relevant to the interaction. For numerical PINs, they would simply be the digits 0 to 9; for passwords, a larger range of alphanumeric and/or graphical symbols could be provided. A helpful technique for the user is to provide pictorial symbols which the user could relate to a remembered - and fictitious - story. This could improve the probability of accurate recall by exploiting the power of visual memory, a technique used by memory "experts" is to convert names, numbers etc into pictures and sequences of pictures forming a storyline.

15 For a numerical PIN, the display consists of a 2-dimensional array of numeric keys, with a "START" key and "END" key, as shown in Figure 4. The user "jogs" the XY control to move off the "START" key onto the first number of the code; this could take several movements, for example getting to the "9" target from the "START". In a basic implementation, the design would allow movement in the four main directions UP, RIGHT, DOWN and LEFT, or might also allow diagonal movements as well to give eight in all. The grid size and spacing is determined as integer numbers of "clicks" (depressions of the movement control) to give the user an accurate idea of where the cursor lies: where movement control is by continuous movement means such as a mouse, the size of the targets should be greater to give a greater probability of the cursor being in the space where the user

intends it to be. Whenever a key is reached which corresponds to the next digit in the code, a button on the controller is pressed to select that digit as a part of the code. Completion is indicated by clicking on the "END" key or, if no specific "END" key is provided, on the last target of the sequence. If the user was conscious of making an error, clicking on the "START" key could clear the code and re-start. The layout shown in Figure 4 would provide  $10^n$  codes, where  $n$  is the number of digits in the code, and codes could be of arbitrary length. Where there is no select function, and the code is entered by simply moving through targets in a predetermined order, the number of possible codes is of course reduced by the adjacency requirement for the numbers in the sequence.

To further improve the security, the system may be set up to rearrange some or all of the targets for each attempt to enter the code, as shown by Figure 5. A third party would then only be able to learn a users security code by observing both the movement instructions input by the user and the arrangement and identity of targets at that time.

In a modified embodiment, the idea of changing target arrangements is extended to an interaction using a sequence of choice patterns A, B and C, one for each symbol in the code as shown in Figure 6 for a three-target code. The user moves from the origin (start point) of the first arrangement A presented, to one of the eight surrounding pictures (targets). As soon as this is done, or following selection if required, the choice pattern is replaced by another B, and the user is re-positioned at the origin. In the replacement pattern, the existing targets may simply be rearranged (as with Figures 4 and 5), they may be partially replaced (transition from A to B), or they may be completely replaced (transition from B to C).

When relocated to the origin of the second pattern B, the user chooses a second picture by again moving off the origin. This sequence of moving from the origin and replacement of the pattern continues until the code is complete. The sequence of Figure 6 is only three pictures long; more would probably be needed in practice to give a greater number of possible codes. For the target layout shown, a sequence of  $n$  choice patterns would provide  $8^n$  possible (fixed-length) codes.

As will be appreciated, variations on the above examples are possible. Any suitable layout of targets could be used, and the number of targets could be varied, as shown in Figures 1 and 2. It may even be desirable to repeat some of the targets within the layout, but if the selection of a particular one from a number of repeated targets is important, care must be taken when specifying rearrangement of the pattern (for example with two targets the same, it might be specified that the required one will always appear somewhere in the top row of a grid and the other somewhere in the bottom row). If the controller has two or more buttons which may be used to select, then the use of one or another button may be specified as a conditional feature when entering the code. Audio feedback could be provided so that the user knows they have made a valid movement; the important thing is that no visual effect should occur which could reveal the code the user is entering.

From reading of the present disclosure, other modifications will be apparent to persons skilled in the art. Such modifications may involve other features which already known in the field of security coding techniques and apparatus, and component parts thereof and which may be used instead of or in addition to features already described herein. Although claims have been formulated in this application to particular combinations of features, it should be

understood that the scope of the disclosure of the present application also includes any novel feature or any novel combination of features disclosed herein either explicitly or implicitly, whether or not it relates to the same invention as presently claimed in any claim and whether or not it mitigates any or all of the same technical problems as does the present invention. The applicants hereby give notice that new claims may be formulated to such features and/or combinations of such features during the prosecution of the present application or of any further application derived therefrom.

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## CLAIMS

1. A method for restricting access to a computer-based system having a processor, a display, and user input means arranged to move an indicator about the display under user control, the method requiring correct entry by the user of a predetermined security code as a prerequisite to access, characterised in that;

- the user is presented, via the display, with a first pattern comprising a start point and a plurality of target points arranged related thereto, and the security code comprises a predetermined sequence of the target points;

- the user is required to move the indicator through the predetermined sequence of target points whilst display of the indicator is inhibited; and

- on determining that the indicator has been moved through a sequence of target points, an indication is provided to the user if that sequence does not correspond to the predetermined sequence.

2. A method as claimed in Claim 1, wherein the first pattern further comprises an end point, and the determination that the indicator has been moved through a sequence of target points occurs when the indicator is moved to the end point.

3. A method as claimed in Claim 1, wherein the user input means is operable to select items on the display when indicated by the indicator, and correct entry of the security code further requires selection of a predetermined one or ones of the target points in the predetermined sequence.

4. A method as claimed in Claim 3, wherein for one or more target points of the first pattern, selection of that target point causes the first pattern to be changed to a second pattern of target points.

5 5. A method as claimed in Claim 4, wherein the second pattern comprises the respective target points of the first pattern rearranged on the display.

10 6. A method as claimed in Claim 4, wherein the second pattern includes one or more target points not included in the first pattern.

15 7. A method as claimed in Claim 4, wherein the second pattern includes a start point and, on changing from the first pattern to the second pattern, the indicator is positioned at the start point of the second pattern.

20 8. A method as claimed in Claim 1, wherein returning the indicator to the start point following movement to a target point restarts the users sequence input.

25 9. A method as claimed in Claim 1, wherein for successive attempts to enter the predetermined sequence, the relative positions of the target points of the first pattern are altered.

10. A method as claimed in Claim 1, wherein the target points comprise alphanumeric characters or graphical symbols or a combination of the two.

11. A computer-based apparatus having access restricted by the method of Claim 1, the apparatus including a target point store holding data specifying the respective locations of the target points on the display; a security code store holding at least one security code; first comparator means arranged to receive an identification of current indicator position, compare this with the target point location data from the target store, and output an identification of a currently indicated target point; and second comparator means arranged to receive a sequence of the identifications from the first comparator means, compare that sequence with the code in the security code store, and output one or more signals indicating whether or not there is a match.

12. An apparatus as claimed in Claim 11, wherein the target point store holds a plurality of target point arrangements, the apparatus further comprising pseudo-random selector means operable to select which of the plurality of target point arrangements is to be displayed.

1/2

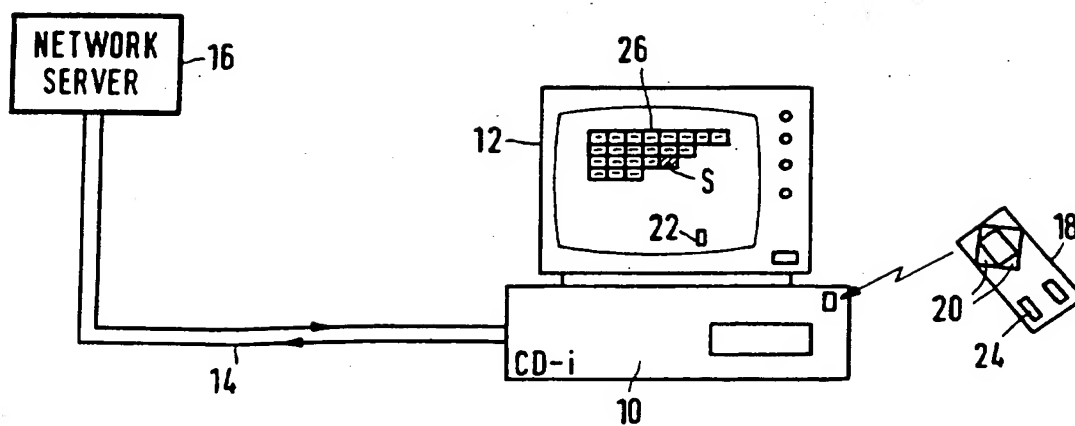


FIG. 1

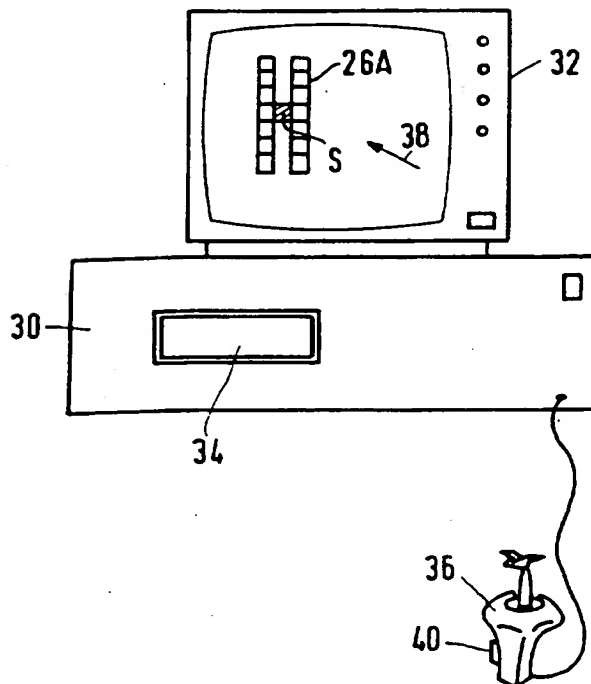


FIG. 2



2/2

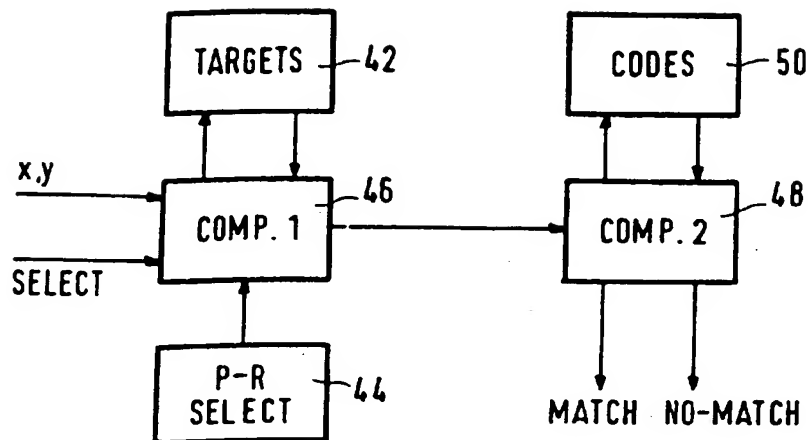


FIG. 3

0	1	2	3
4	START	END	5
6	7	8	9

FIG. 4

8	1	0	3
2	START	END	5
4	7	6	9

FIG. 5

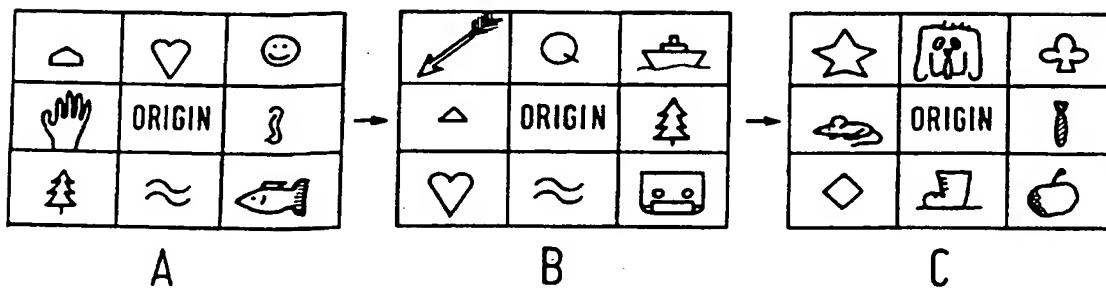


FIG. 6

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB 95/01035

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: G06F 1/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	IBM Technical Disclosure Bulletin, Volume 32, No 10B, March 1990, ., "MENU ICON WITH HIDDEN GEOMETRICAL PASSWORD" page 463 - page 464 --	1-12
X	WO 9311511 A2 (DAVIES, JOHN, HUGH, EVANS), 10 June 1993 (10.06.93), page 8, line 28 - page 9, line 21; page 14, line 15 - line 25 --	1-12
X,P	EP 0677801 A1 (AT & T CORP.), 18 October 1995 (18.10.95) -----	1-12

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

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Information on patent family members

01/04/96

International application No.

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		CA-A- 2123518	10/06/93
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		JP-T- 7502351	09/03/95
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